International Journal of Multiphase Flow

List of Contents and Author Index
Volume 20, 1994

Pergamon

International Journal of Multiphase Flow

exists for publishing theoretical and experimental investigations of multiphase flow which are of relevance and permanent interest

EDITOR

G. Hetsroni
Department of Mechanical Engineering, Technion—Israel Institute of Technology, Haifa, Israel
(*Fax:* -972-432-4533)

ASSOCIATE EDITORS

T. J. Hanratty
Box-3 205 Ral
1209 W. California
Urbana, IL 61801
U.S.A.
(*Fax:* -1-217-244-8068)

L. G. Leal
Department of Chemical and Nuclear Engineering
University of California
Santa Barbara, CA 93106
U.S.A.
(*Fax:* -1-805-893-4731)

R. I. Nigmatulin
Institute of Mechanics
Lomonosov University of Moscow
Michurinsky pr.1, GSP, V-192
Moscow 119899, Russia
(*Fax:* -7-095-253-9004)

Y. Tsuji
Department of Mechanical Engineering
Osaka University
Suita, Osaka 565
Japan
(*Fax:* -81-6-876-4975)

G. Yadigaroglu
Institut für Energietechnik
ETH-Zentrum CLT
8092 Zurich
Switzerland
(*Fax:* -41-1-632-1166)

D. D. Joseph
Department of Aerospace Engineering and Mechanics
University of Minnesota
107 Akerrman Hall
110 Union St
Minneapolis, MN 55455
U.S.A.

EDITORIAL ADVISORY BOARD

K. Akagawa, Kobe, Japan
S. G. Bankoff, Evanston, IL
J. A. Bouré, Grenoble, France
H. Brenner, Cambridge, MA
X.-J. Chen, Xian, China
J. G. Collier, Gloucester, England
J. M. Delhaye, Grenoble, France
N. Epstein, Vancouver, Canada
H. K. Fauske, Argonne, IL
P. Griffith, Cambridge, MA
Y. Katto, Tokyo, Japan
F. Mayinger, Munich, Germany
I. Michiyoshi, Kyoto, Japan
O. Molerus, Erlangen, Germany
U. Müller, Karlsruhe, Germany
V. E. Nakoryakov, Novosibirsk, Russia
P. R. Owen, London, England
R. L. Peskin, Rutgers, NJ
R. Semeria, Grenoble, France
A. Serizawa, Kyoto, Japan
H. C. Simpson, Glasgow, Scotland
S. L. Soo, Urbana, IL
T. Ueda, Tokyo, Japan
G. B. Wallis, Hanover, NH

Publishing Office
(*Production Editor:* Sarah Gooding)
Elsevier Science Ltd, Bampfylde Street, Exeter EX1 2AH, England
[*Tel.* Exeter (01392) 51558; *Fax* 425370].

Subscription and Advertising Offices
North America: Elsevier Science Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, U.S.A.
Rest of the World: Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, England
[*Tel.* Oxford (01865) 843000; *Fax* 843010].

Subscription Rates
Annual Institutional Subscription Rates 1995: North, Central and South America, US$947; Rest of the World, £635. Associated Personal Subscription Rates are available on request for those whose institutions are library subscribers. Sterling prices exclude VAT. Non-VAT registered customers in the European Community will be charged the appropriate VAT in addition to the price listed. Prices include postage and insurance and are subject to change without notice.

Back Issues
Back issues of all previously published volumes, in both hard copy and microform, are available direct from Elsevier Science offices.

Second class postage paid at RAHWAY, NJ. Postmaster send address corrections to *International Journal of Multiphase Flow*, c/o Elsevier Science Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, U.S.A.

Published 7 issues/annum in February, April, June, August, September, November and December

Copyright © 1994 Elsevier Science Ltd

LIST OF CONTENTS

Number 1

L. P. Yarin and **G. Hetsroni**	1	Turbulence intensity in dilute two-phase flows—1. Effect of particle-size distribution on the turbulence of the carrier fluid
L. P. Yarin and **G. Hetsroni**	17	Turbulence intensity in dilute two-phase flows—2. Temperature fluctuations in particle-laden dilute flows
L. P. Yarin and **G. Hetsroni**	27	Turbulence intensity in dilute two-phase flows—3. The particles–turbulence interaction in dilute two-phase flow
Y. Katto	45	Limit conditions of steady-state countercurrent annular flow and the onset of flooding, with reference to the CHF of boiling in a bottom-closed vertical tube
G. Zheng, J. P. Brill and **Y. Taitel**	63	Slug flow behavior in a hilly terrain pipeline
G. D. Lock	81	Experimental measurements in a dusty-gas shock tube
I. Silverman and **W. A. Sirignano**	99	Multi-droplet interaction effects in dense sprays
C. Zhu, S.-C. Liang and **L.-S. Fan**	117	Particle wake effects on the drag force of an interactive particle
A. K. Stubos and **J.-M. Buchlin**	131	Vapour channels in boiling, unconstricted particle beds—effect on the dryout heat flux
R. Di Felice	153	The voidage function for fluid–particle interaction systems
M. Benali and **K. Shakourzadeh-Bolouri**	161	The gas–solid–solid packed contactor: hydrodynamic behaviour of counter-current trickle flow of coarse and dense particles with a suspension of fine particles
D. Panda, A. Parida, J. S. Murty and **A. K. Mitra**	171	Transportation of coarse coal in a fine medium
L. C. Dickey and **E. R. Radewonuk**	179	Compressed condensation of water vapor on chilled brine
H. J. Keh and **C. H. Tseng**	185	Slow motion of an arbitrary axisymmetric body along its axis of revolution and normal to a plane surface

Brief Communication
R. D. Cohen 211 Effect of viscosity on drop breakup

217 Book Review

I Announcements

Number 2

C. E. Lacy and **A. E. Dukler*** 219 Flooding in vertical tubes—I. Experimental studies of the entry region

C. E. Lacy and **A. E. Dukler*** 235 Flooding in vertical tubes—II. A film model for entry region flooding

R. Ulbrich and **D. Mewes** 249 Vertical, upward gas–liquid two-phase flow across a tube bundle

R. Mei 273 Effect of turbulence on the particle settling velocity in the nonlinear drag range

H. Herm Stapelberg and **D. Mewes** 285 The pressure loss and slug frequency of liquid–liquid–gas slug flow in horizontal pipes

S. Rapagná, P. U. Foscolo and **L. G. Gibilaro** 305 The influence of temperature on the quality of gas fluidization

J. G. Sun, M. M. Chen and **B. T. Chao** 315 Modeling of solids global fluctuations in bubbling fluidized beds by standing surface waves

P. Cherukat, J. B. McLaughlin and **A. L. Graham** 339 The inertial lift on a rigid sphere translating in a linear shear flow field

G. S. Ribeiro, A. S. Vargas and **M. N. Frota** 355 Pressure drop induced by a sphere settling in non-Newtonian fluids

C. W. M. van der Geld and **H. Vermeer** 363 Prediction of drop size distributions in sprays using the maximum entropy formalism: the effect of satellite formation

A. Prakash and **J. N. Koster** 383 Convection in multiple layers of immiscible liquids in a shallow cavity—I. Steady natural convection

A. Prakash and **J. N. Koster** 397 Convection in multiple layers of immiscible liquids in a shallow cavity—II. Steady thermocapillary convection

J. Lewalle, K. M. Singh and **J. P. Bambacht** 415 Analysis of the wet pressing of paper pulp

B. J. Lowry and **P. H. Steen** 439 Stabilization of an axisymmetric liquid bridge by viscous flow

Brief Communication

V. Ilic and **J. Vincent** 445 Sedimentation of complex-shaped particles in a square tank at low Reynolds numbers

I Announcements

Number 3

A. Alajbegović, A. Assad, F. Bonetto and **R. T. Lahey Jr** 453 Phase distribution and turbulence structure for solid/fluid upflow in a pipe

A. Huang, C. Christodoulou and **D. D. Joseph** 481 Friction factor and holdup studies for lubricated pipelining—II

D. B. Murray 493 Local enhancement of heat transfer in a particulate cross flow—I. Heat transfer mechanisms

D. B. Murray 505 Local enhancement of heat transfer in a particulate cross flow—II. Experimental data and predicted trends

C. Unal, O. Badr, K. Tuzla, J. C. Chen and **S. Neti** 515 Pressure drop at rod-bundle spacers in the post-CHF dispersed flow regime

C. M. Kinoshita, H. Teng and **S. M. Masutani** 523 A study of the instability of liquid jets and comparison with Tomotika's analysis

A. Bos and **J. G. du Chatinier** 535 The front shape of a sphere-propelled liquid slug in a natural-gas pipeline

D. J. Vojir and **E. E. Michaelides** 547 Effect of the history term on the motion of rigid spheres in a viscous fluid

M. Olim, M. E. H. van Dongen, T. Kitamura and **K. Takayama** 557 Numerical simulation of the propagation of shock waves in compressible open-cell porous foams

B. V. Ramarao and **C. Tien** 569 Concentration fields in dusty gas flows

K. Zhang and **A. Acrivos** 579 Viscous resuspension in fully developed laminar pipe flows

Ch. Malamatenios, K. C. Giannakoglou and **K. D. Papailiou** 593 A coupled two-phase shear layer/liquid film calculation method. Formulation of the physical problem and solution algorithm

S. Abid and **A. K. Chesters** 613 The drainage and rupture of partially-mobile films between colliding drops at constant approach velocity

I. Rampall and **D. T. Leighton Jr** 631 Influence of shear-induced migration on turbulent resuspension

J. B. W. Kok and **A. A. J. Benschop** 651 Propagation velocity and rate of attenuation of surface waves on a homogeneously fluidized bed

I. Owen and **I. B. Hussein** 659 The propulsion of an isolated slug through a pipe and the forces produced as it impacts upon an orifice plate

Letter to the Editor
H. Chanson and **P. D. Cummings** 667 An experimental study on air carryunder due to a plunging liquid jet

Number 4

G. Hetsroni and **R. Rozenblit** 671 Heat transfer to a liquid–solid mixture in a flume

L. A. Dykhno, L. R. Williams and **T. J. Hanratty** 691 Maps of mean gas velocity for stratified flows with and without atomization

H. Schmidt and **R. Loth** 703 Predictive methods for two-phase flow pressure loss in tee junctions with combining conduits

Rizwan-uddin 721 On density-wave oscillations in two-phase flows

K. Minami and **O. Shoham** 739 Transient two-phase flow behavior in pipelines—experiment and modeling

M. Iguchi, T. Kondoh and **T. Uemura** 753 Simultaneous measurement of liquid and bubble velocities in a cylindrical bath subject to centric bottom gas injection

M. Matsukata, K. Suzuki, K. Ueyama and **T. Kojima** 763 Development of a microwave plasma-fluidized bed reactor for novel particle processing

A. J. J. van der Zanden and **A. K. Chesters** 775 An experimental study of the meniscus shape associated with moving liquid–fluid contact lines

A. J. J. van der Zanden and **A. K. Chesters** 789 An approximate solution of the hydrodynamic problem associated with moving liquid–liquid contact lines

Brief Communication
G. B. Wallis 799 Added mass coefficients for uniform arrays

I Announcement

Number 5

M. Lopez de Bertodano, R. T. Lahey Jr and **O. C. Jones** 805 Phase distribution in bubbly two-phase flow in vertical ducts

J. R. Buell, H. M. Soliman and **G. E. Sims** 819 Two-phase pressure drop and phase distribution at a horizontal tee junction

E. L. Bibeau and **M. Salcudean** 837 Subcooled void growth mechanisms and prediction at low pressure and low velocity

M. R. Davis and **D. Wang**	865	Dual pressure drop metering of gas–liquid mixture flows
J. Weisman, J. Lan and **P. Disimile**	885	Two-phase (air–water) flow patterns and pressure drop in the presence of helical wire ribs
J. L. Baliño and **J. Converti**	901	Saturated CHF in horizontal eccentric annuli for low mass fluxes: measurement and modelling
H. K. Kytömaa and **S. W. Corrington**	915	Ultrasonic imaging velocimetry of transient liquefaction of cohesionless particulate media
Y. A. Sergeev and **M. Y. Muromsky**	927	On propagation of concentration disturbances in a magnetically stabilized fluidized bed
S. V. Paras, N. A. Vlachos and **A. J. Karabelas**	939	Liquid layer characteristics in stratified–atomization flow
G. Breyiannis, D. Valougeorgis, V. Bontozoglou and **A. Goulas**	957	An inviscid investigation of the initiation of roll waves in horizontal gas–liquid flows
L. M. Liljegren	969	The influence of a mean fluid velocity gradient on the particle–fluid velocity covariance
	I	Announcements

Number 6

M. St-Georges and **J. M. Buchlin**	979	Detailed single spray experimental measurements and one-dimensional modelling
J. S. Duffield, G. Friz and **R. Nijsing**	993	Critical flow in a chemically reacting two-phase multicomponent mixture
Y. Joo and **V. K. Dhir**	1009	An experimental study of drag on a single tube and on a tube in an array under two-phase cross flow
S. Sundaram and **L. R. Collins**	1021	Spectrum of density fluctuations in a particle–fluid system—I. Monodisperse spheres
S. Sundaram and **L. R. Collins**	1039	Spectrum of density fluctuations in a particle–fluid system—II. Polydisperse spheres
I. Celik and **Y.-Z. Wang**	1053	Numerical simulation of circulation in gas–liquid column reactors: isothermal, bubbly, laminar flow
B. J. Azzopardi	1071	The split of vertical annular flow at a large diameter T junction
Igor Carron and **Frederick R. Best**	1085	Gas–liquid annular flow under microgravity conditions: a temporal linear stability study

M. Takahashi, Y. Yamazaki and **A. Inoue**	1095	Liquid single- and gas–liquid two-phase flows of magnetic fluid in the presence of a high non-uniform parallel magnetic field
M. Taeibi-Rahni, E. Loth and **G. Tryggvason**	1109	Flow modulation of a planar free shear layer with large bubbles—direct numerical simulations
Rizwan-uddin	1129	Effects of double-humped axial heat flux variation on the stability of two-phase flow in heated channels
D. Schroeder-Richter and **G. Bartsch**	1143	Analytical calculation of DNB-superheating by a postulated thermo-mechanical effect of nucleate boiling
	1169	Book Reviews
	III	Announcements

Annual Reviews in Multiphase Flow

Foreword	v	
M. Andreani and **G. Yadigaroglu**	1	Prediction methods for dispersed flow film boiling
Y. Katto	53	Critical heat flux
E. Elias and **G. S. Lellouche**	91	Two-phase critical flow
J. K. Eaton and **J. R. Fessler**	169	Preferential concentration of particles by turbulence
J. B. McLaughlin	211	Numerical computation of particles–turbulence interaction
Y. Hardalupas, A. M. K. P. Taylor and **J. H. Whitelaw**	233	Mass flux, mass fraction and concentration of liquid fuel in a swirl-stabilized flame
W. D. Bachalo	261	Experimental methods in multiphase flows
J. G. Yates and **S. J. R. Simons**	297	Experimental methods in fluidization research
L. R. Glicksman, M. R. Hyre and **P. A. Farrell**	331	Dynamic similarity in fluidization
D. Barnea and **Y. Taitel**	387	Interfacial and structural stability of separated flow